

Energy Star Directional Luminaire Test Report

For

Espen Technology, Inc

12257 FLORENCE AVE SANTA FE SPRINGS, CA 90670 USA

Downlights

Model Name(s):
VEKR6D/8T/13W-10V

Representative (Tested) Model:
VEKR6D/8T/13W-10V

Model Difference: Product is color tunable, can be tunable from 3000K, 3500K and 4000K.

Prepare by:



Engineer: Alan Wang
Date: 2021-05-27

Review by:



Technical Lead: Vincent Yuan
Issue Date: 2021-06-02
Revised Date: N/A

Note:

1. The results contained in this report pertain only to the tested samples.
2. This report shall not be reproduced, no limited part or full, without approval of Dongguan New Testing Centre Co., Ltd
3. This report does not imply product certification, approval, or endorsement by NVLAP, or any agency of the Federal Government.

Client Information:

Applicant Name:	Espen Technology, Inc
Brand Name:	Espen
Manufacturer Name:	Espen Technology, Inc
Manufacturer Address:	12257 FLORENCE AVE SANTA FE SPRINGS, CA 90670 USA

Product Information:

Model Number:	VEKR6D/8T/13W-10V
Product Type:	Downlights
Rating Input:	120-277Vac, 50/60Hz, 7/9/13W
Declared CCT:	3000K/3500K/4000K
Declared Lifetime:	50000 hours
LED Manufacturer:	Lextar Electronics Corp.
LED Model:	PC35H13
LED Quantity:	48 pcs
Dimming Type:	Dimmable

Test Information:

Standard Lamp:	Total Spectral Radiant Flux Standard Lamp, trace to NIST. 1. D908S for Gonio 2. D215S for Integrating Sphere
Dimmer Manufacturer:	Lutron
Dimmer Model:	[X] NTSTV-DV [] DVCL-153P [] SCL-153P
Date of Receipt Samples:	2021-05-26
Quantity of Receipt Samples:	3 pcs
Sample Number:	210526001-S1~S3

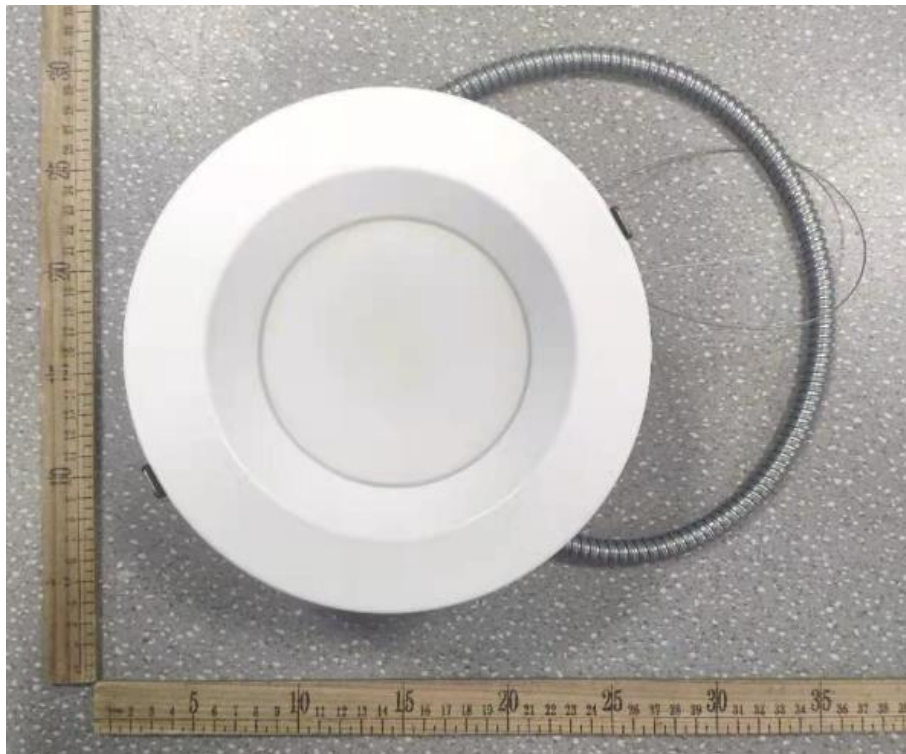
Laboratory Information:

Test Laboratory:	Dongguan New Testing Centre Co., Ltd
Laboratory Address:	3F, No. 1 the 1 st North Industry Road, Songshan Lake Science & Technology Park, Dongguan, Guangdong, China
Laboratory Contact Name:	Neil Zhong
Laboratory Contact E-mail:	Neil_zhong@ntc-cert.com

Report Information:

Issued Date of Test Report:	2021-06-02
Revised Date of Test Report:	N/A
Test Report No.:	NTCLR21050215
Remark (If applicable):	1. The lowest CCT with the maximum wattage was tested, which is the default and most consumptive condition.

Photo of Sample



Annex					
Regulatory Body	Test Method Regulation or Program Evaluated to	Tests to Determine Compliance	Test Limit Per Regulation or Program Requirement	Measured Efficiency or Limit Level	Pass or Fail
9 PHOTOMETRIC PERFORMANCE REQUIREMENTS					
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 9.2	Luminaire Efficacy (Initial)	$\geq 55 \text{ lm/W}$	123.30 lm/W	Pass
		Luminaire Minimum Light Output (Initial)	$\leq 4.5''$ aperture: 345 lumens $> 4.5''$ aperture: 575 lumens	1549.9 lm	Pass
		Luminaire Zonal Lumen Density	75% of total lumens within the 0-60° zone	89.1%	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 9.3	Rated Correlated Color Temperature (CCT)	One of the following nominal correlated color temperatures (CCTs): 2700 Kelvin 3000 Kelvin 3500 Kelvin 4000 Kelvin 5000 Kelvin	3000K 3500K 4000K	Pass
		Measured Correlated Color Temperature (CCT)	One of the following targets correlated color temperatures (CCTs): $2725 \pm 145 \text{ K}$ $3045 \pm 175 \text{ K}$ $3465 \pm 245 \text{ K}$ $3985 \pm 275 \text{ K}$ $5028 \pm 283 \text{ K}$	3002K (@ 120Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 9.4	Color Rendering Index (CRI)	$R_a \geq 80$ & $R_9 > 0$	$R_a=82.3$ & $R_9=4$ (@ 120Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 9.5	Color Angular Uniformity	The variation of chromaticity shall be within a total linear distance of 0.006 from the weighted average point on the CIE 1976 (u',v') diagram.	0.0019	Pass

10 LUMEN MAINTENANCE AND RATED LIFE REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 10.1	Lumen Maintenance	Shall meet the following L70 rated lumen maintenance life values, in situ: L70(6k) ≥ 25,000 hours for indoor L70(6k) ≥ 35,000 hours for outdoor L70 ≥ 50,000 hours for inseparable luminaires	> 60000 hours	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 10.1	Maximum In-Situ Source Temperature	1. In the sample luminaire, the in situ TMPLD temperature is less than or equal to the temperature specified in the LM-80 test report for the corresponding or higher drive current. 2. The drive current measured in the luminaire is less than or equal to the drive current specified in the LM-80 test report at the corresponding temperature or higher.	71.2°C ≤ 85 °C 53.5 mA ≤ 100 mA (@ 120Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 10.2	Light Source Life	Shall meet the following L70 lumen maintenance life vales: ≥ 25,000 hours for indoor luminaires ≥ 35,000 hours for outdoor luminaires ≥ 50,000 hours for inseparable luminaires	>60000hours	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 10.3	Color Maintenance	For all LM-80 samples, at any measurement point, the distance of the chromaticity coordinates from the initial (zero-hour) chromaticity coordinates shall not exceed 0.007 at the temperature(s) adjacent to the measured in situ TMPLD temperature, and at the corresponding drive current.	LM-80 report has been verified and the chromaticity shift (Δu'v') is 0.0035	Pass

11 ELECTRICAL PERFORMANCE REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 11.1	Source Star Time	Light Source shall remain continuously illuminated within 750 milliseconds of application of electrical power	328.0 ms (@120 Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 11.3	Power Factor	Total Luminaire input power ≤ 5 watts: $PF \geq 0.5$ Total luminaire input power > 5 watts: $PF \geq 0.7$	0.9857 (@120 Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 11.4	Transient Protection	The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.	During and after test, the product operated normally	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 11.5	Standby Power Consumption	Luminaire shall not draw power in the off state.	0W	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 11.6	Operating Frequency	≥ 120 Hz	120.0 Hz (@ 120Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 11.6	Flicker	$P_{st} \leq 1.0$ $SVM \leq 1.6$	$P_{st}=0.198$ $SVM=0.714$	Pass

12 LUMINAIRE SERVICEABILITY REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 12.1	Light Source Replaceability	LED light engines or retrofit kits shall make use of electrical interconnects that allow for consumer replacement of the engine or kit without the cutting of wires or the use of solder. Wire nuts and other reusable connectors are allowed.	Validated	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 12.2	Ballast/Driver Replaceability	Ballast/Driver shall make use of electrical interconnects that allow for consumer replacement of the ballast/driver without the cutting of wires or the use of solder. Wire nuts and other reusable connectors are allowed.	Validated	Pass

13 THERMAL PERFORMANCE REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 13.1	Maximum Measured Ballast or Driver Case Temperature	At the temperature measurement point for the hottest location on the driver case (TMPC as detailed by the driver manufacturer), the measured driver case temperature at thermal equilibrium shall not exceed the driver manufacturer's maximum recommended temperature during in situ (installed in the luminaire) operation.	87.6°C < 105°C (@ 120Vac)	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 13.2	Recessed Downlight Thermal Performance	Insulation contact (Type IC): Recessed downlights marketed as Type IC shall be approved for zero clearance insulation cover by an OSHA NRTL laboratory.	N/A	N/A

14 SAFETY REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 14.1	Indoor Luminaire Safety	Demonstrate compliance with ANSI/UL 1574-2004, ANSI/UL 1598-2008, ANSI/UL 1598C-2014, ANSI/UL 2108-2004 or 2015, ANSI/UL 8750-2009 or 2015, as applicable.	Validated	Validated
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 14.2	Electronic Ballast or Driver Safety	Demonstrate compliance with ANSI/UL 1310-2010, ANSI/UL 2108-2004 or 2015, ANSI/UL 8750-2009 or 2015, as applicable.	Validated	Validated

15 CONTROL REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 15.1	Dimming	The luminaire and its components shall provide continuous dimming from 100% to 20% of light output. Luminaire shall not emit noise above 24dBA at 1 meter or less at the minimum output.	15.8 dBA	Pass
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 15.2	Products with Connected Functionality (Optional)	Product must continue to comply with the applicable product safety standards – the addition of the functionality shall not override existing safety protections and functions. Must comply with section 11.5 Standby Power.	N/A	N/A

16 PRODUCT LABELING & PACKAGING REQUIREMENTS

Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 16.1	Labeling & Packaging	Packaging and marketing claims shall represent the product consistent with its certification.	Validated	Pass
		Labeling & Packaging	Packaging shall clearly describe the nominal color designation of the lamp in units of Kelvin (e.g. 2700K, 3000K) and may display recommended corresponding nomenclature as outlined below. This can also be met through use of a Lighting Facts label (as applicable). 2700 – Soft White 3000 – Warm White 3500 – Neutral White 4000/4100K – Cool White 5000K – Daylight	Validated	Pass
		Labeling & Packaging	For luminaires shipped with lamps containing mercury: Both the lamp and the luminaire packaging shall have a label indicating mercury content which must be managed and disposed of properly, and shall reference: www.epa.gov/cfl	N/A	N/A
		Labeling & Packaging	For outdoor luminaires: Packaging shall indicate the minimum (lowest) starting temperature for the lamp and ballast platform of the luminaire.	N/A	N/A

		Labeling & Packaging	For luminaires marketed as dimmable: Luminaire packaging shall indicate dimming range (as applicable), a list or web site address with compatible dimmers or other controls, and known incompatibilities with dimmers, occupancy or vacancy sensors, timing devices or other external lighting controls, or a message noting limitations and web site address to find out more specific information. Step dimming capability, if employed, shall be clearly indicated.	Validate	Pass
		Labeling & Packaging	For recessed downlight luminaires that are insulation-contact (Type IC) rated: Packaging shall clearly state this rating. Sample language: "IC-rated for direct contact with insulation".	N/A	N/A
		Labeling & Packaging	For recessed downlight luminaires that are airtight (AT) certified: Packaging shall indicate that the luminaire permits air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283-04. Sample language: "Certified airtight per ASTM E283-04."	N/A	N/A
Energy Star	ENERGY STAR ® Program Requirement Product Specification for Luminaire (Light Fixture) Eligibility Criteria Version V2.2 Section 16.2	Light Source Shipment	Complete light source components shall be provided with the luminaire or retrofit kit.	Validated	Pass
		Warranty	Integrated LED lamps shipped with the luminaire shall carry a minimum 3 year warranty. For luminaires incorporating non-replaceable drivers, the above warranty requirement is extended to 5 years. Warranty language shall place no limitations on coverage based on duration of luminaire operation (e.g. hours per day).	5 years	Pass

Test Specification:

Date of Test	2021-05-26~2021-05-27
Test Item	1. Total Luminous Flux 2. Luminous Efficacy 3. Correlated Color Temperature 4. Color Rendering Index 5. Chromaticity Coordinate 6. Transient Protection 7. Source Start Time 8. Operation Frequency 9. Audible Noise 10. Flicker 11. In-Situ Temperature Measured Test 12. Maximum Measured Driver Case Temperature
Reference Standard	ENERGY STAR® Program Requirements for Luminaires IES LM-79-2008 Electrical and Photometric Measurements of Solid-State Lighting Products IES LM-84-14 IES Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires ANSI C78.377-2017 Specifications for the Chromaticity of Solid State Lighting Products CIE 13.3-1995 Method of Measuring and Specifying Color Rendering Properties of Light Sources CIE 15-2004 Technical Report Colorimetry NEMA-77-2017 Standard for Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria ANSI/IEEE C62.41 (Category A) Recommended Practice on Surge Voltages in Low – Voltage AC Circuits ANSI/UL 1598-2018 Luminaire

Test Methods:
1. Photometric and Electrical Measurements – Integrating Sphere Method:

Photometric parameters were measured using an integrating sphere, as spectroradiometer and software. The ambient temperature condition inside the sphere was measured at 25 °C±1°C. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. The sample was operated at require Voltage and Frequency. It was stabilized before measurement was made. Chromaticity Coordinates, Correlated Color Temperature and Color Rendering Index were calculated from the spectral radiant flux measurements taken at least 1 nm intervals over the rage of 380 to 780 nm.

2. Transient Protection Test

The transient protection tests at ambient temperature were performed on one sample. The sample was operated at rated input voltage in the base - up orientation during the tests. Test system with an 100kHz Ring Wave Module and a Coupler/Decoupler Module was used to generate the 2500 volt ring wave transient strike across the lamp base contacts. Each wave consisted of a 0.5 microsecond rise time. Seven strikes were performed on each lamp sample in accordance with ANSI/IEEE C62.41 (Category A): Recommended Practice on Surge Voltages in Low – Voltage AC Circuits.

3. Source Start Time

Each test sample was operated in its designated orientation at rated input voltage in a $25\text{ }^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ambient. The sample was operated at 120 Volts AC, 60 Hz. A photodetector is used to monitor the luminaire light output. Time shall be measured by a Flicker Photometer.

4. Operation Frequency

Each test sample was operated at rated input voltage. The sample was operated at 120 Volts AC, 60Hz. Light output waveform shall be measured by a Flicker Photometer.

5. In-Situ Temperature Measurement Test (ISTMT)

According to UL 1598 and IES LM-84-14, Annex A, maximum LED source operated temperature measurements were taken on one test sample per model with a thermocouple and temperature meter. The SSL sample could reach thermal equilibrium for at least 3 hours before measurements were taken. LED source temperature was measured at the point as indicated by the included diagram in accordance with manufacturers declared hot spot location. The maximum temperature was recorded for the sample. A simulated ceiling or other enclosure may be used in accordance to UL 1598 as applicable.

6. Maximum Measured Ballasted or Driver Case Temperature

Maximum driver case temperature measurement was taken on one test sample per model with a thermocouple and temperature meter. The SSL sample was allowed to reach thermal equilibrium for at least 3 hours before measurements were taken. Driver case temperature was measured at the point as indicated by the included diagram in accordance with manufacturers declared hot spot location. The maximum temperature was recorded for the sample. A simulated ceiling or other enclosure may be used in accordance to UL 1598 as applicable.

Integrating Sphere Test Results:

Test Condition:

Test Ambient (°C)	Test Humidity (%)	Orientation	Stabilization Time (minute)	Test Time (minute)
25.0	53.7	Face Down	90	10

Electrical Data:

CCT setting	Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
3000K	120.0	60	0.1063	12.57	0.9857
3500K	120.0	60	0.1038	12.26	0.9847
4000K	120.0	60	0.1055	12.47	0.9854

Color Data:

CCT setting	CCT (K)	R _a	R ₉	Chromaticity		
				(x, y)	(u', v')	Duv
3000K	3002	82.3	4	(0.4347,0.3996)	(0.2510,0.5193)	-0.0015
3500K	3407	83.5	9	(0.4099,0.3915)	(0.2384,0.5123)	-0.0006
4000K	3868	82.0	2	(0.3886,0.3875)	(0.2261,0.5074)	0.0027

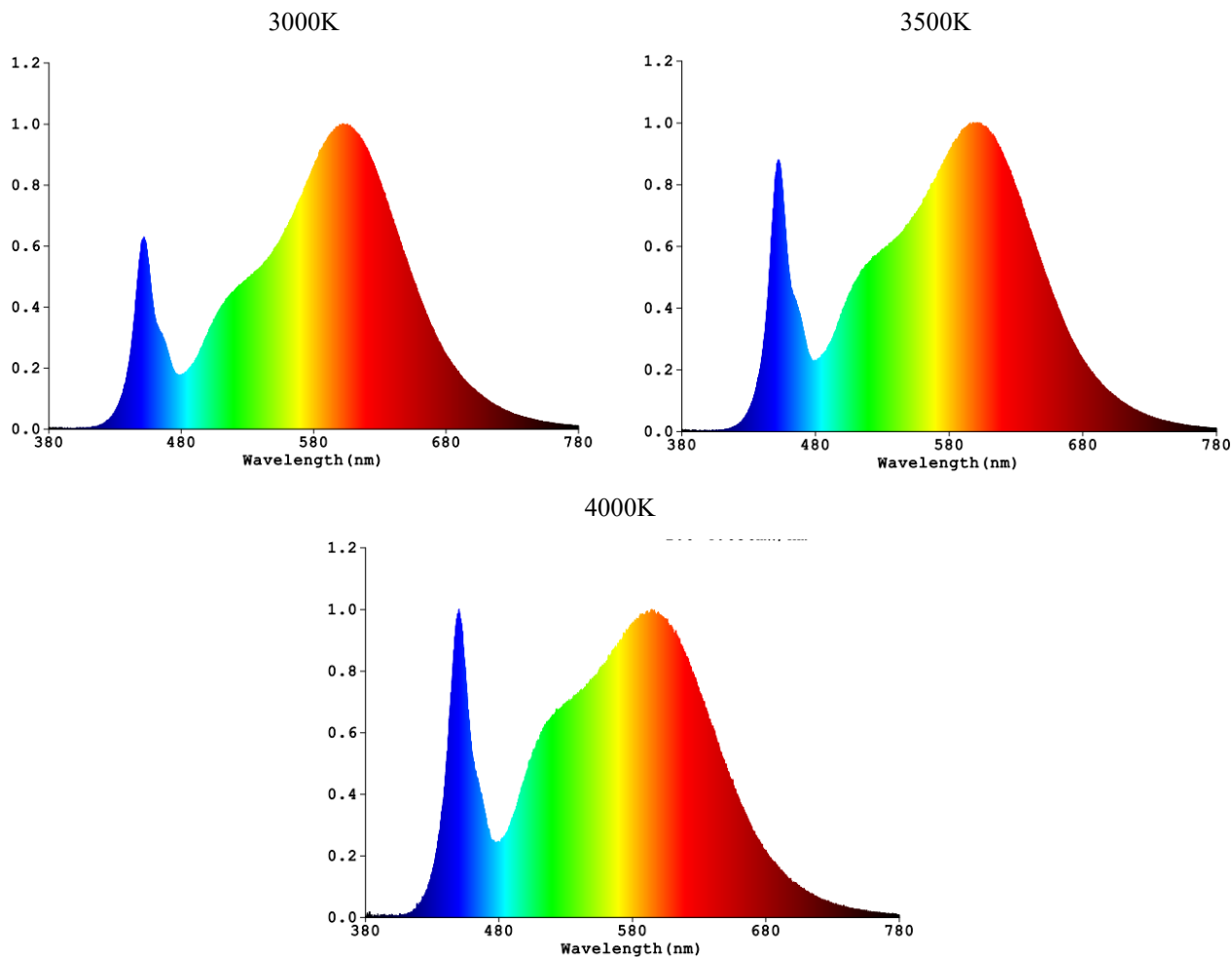
Specified Color Rendering

CCT setting	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
3000K	81	92	95	80	82	90	81	57	4	81	80	71	84	98	73
3500K	82	92	96	82	82	89	84	61	9	80	81	67	85	99	75
4000K	80	88	95	82	80	84	86	62	2	72	81	61	82	97	73

Output Data:

CCT setting	Light output (lm)	Efficacy (lm/W)
3000K	1549.9	123.30
3500K	1632.0	133.12
4000K	1622.2	130.09

Spectrum Diagram:



Color Angular Uniformity

Test Result	Maximum $\Delta u'v'$
	0.0019

Goniophotometer Test Results:

Test Condition:

Test Ambient (°C)	Test Humidity (%)	Orientation	Stabilization Time (minute)	Test Time (minute)
25.1	54.2	Face Down	90	25

Electrical Data:

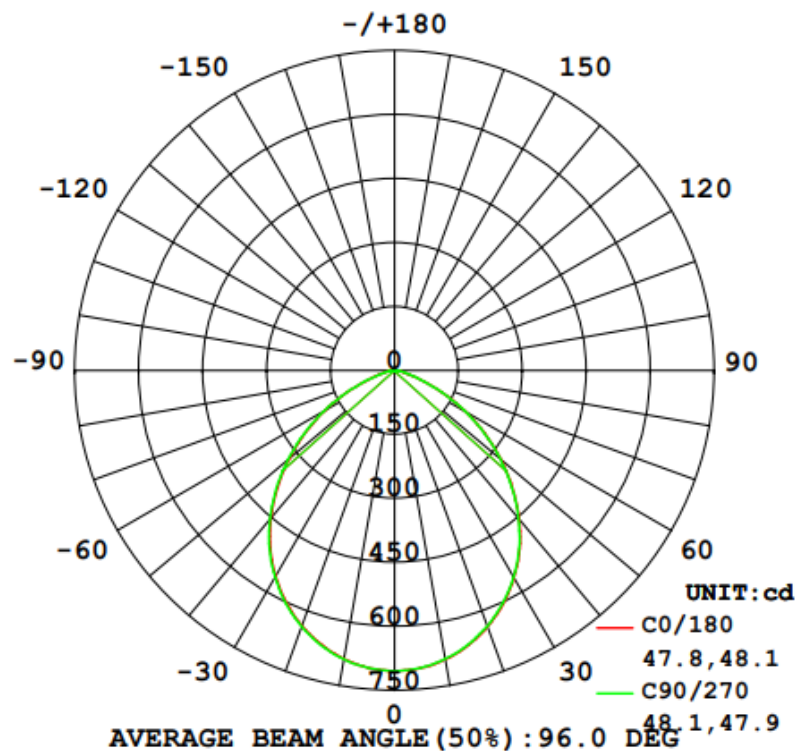
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1063	12.57	0.9857

Goniophotometer Data:

Parameter	Results
Total Luminous (lm)	1549.9
Luminous Efficacy (lm/w)	123.30
Zonal Lumens Distribution (0-60°)	89.1%
Beam Angle (°)	96.0
Center Beam Candle Power (cd)	705

Luminous Intensity Distribution Diagram:

LUMINOUS INTENSITY DISTRIBUTION DIAGRAM

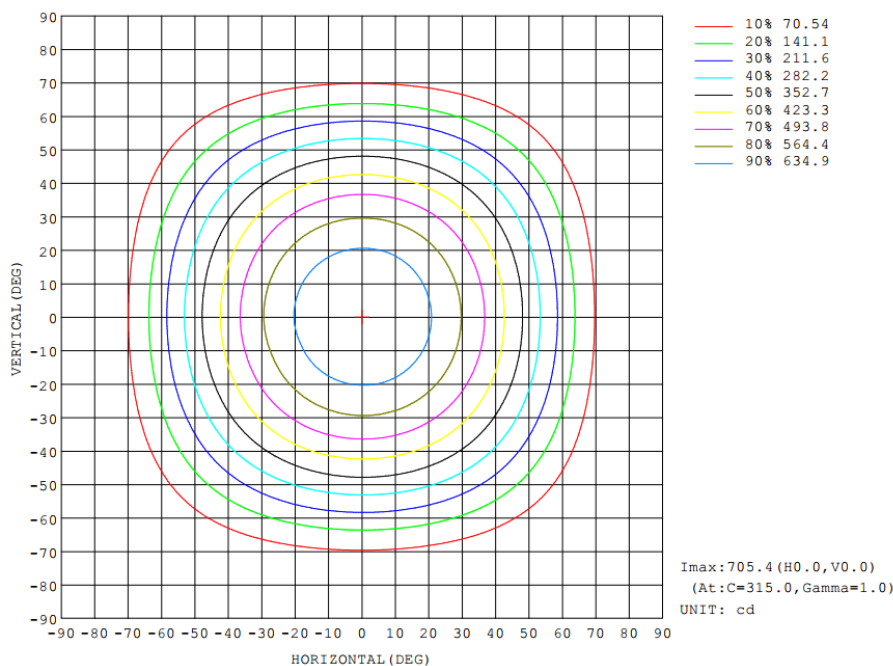


Zonal Flux Diagram:

ZONAL FLUX DIAGRAM:

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	zone	total	%lum, lamp
10	688.3	687.7	687.0	686.1	686.6	686.8	687.6	688.7	0- 10	66.43	66.43	4.29,4.29
20	639.5	638.7	637.3	636.0	636.7	637.5	638.8	640.1	10- 20	187.8	254.2	16.4,16.4
30	561.1	560.5	559.1	556.9	558.2	559.4	560.9	562.1	20- 30	277.1	531.4	34.3,34.3
40	455.0	454.5	452.5	450.0	452.0	453.2	455.1	456.7	30- 40	318.5	849.9	54.8,54.8
50	327.0	326.6	324.5	321.9	323.6	325.2	327.1	328.8	40- 50	301.1	1151	74.3,74.3
60	191.3	191.0	189.5	187.9	189.9	190.8	192.1	193.3	50- 60	230.5	1381	89.1,89.1
70	66.78	66.86	67.17	67.51	69.34	69.06	68.51	68.22	60- 70	124.5	1506	97.2,97.2
80	13.88	14.07	14.33	14.54	15.07	14.99	14.68	14.31	70- 80	37.25	1543	99.6,99.6
90	0.0005	0.0004	0.0066	0.0056	0.0041	0	0	0	80- 90	6.776	1550	100,100
100	0	0	0	0	0	0	0	0	90-100	0.0001	1550	100,100
110	0	0	0	0	0	0	0	0	100-110	0	1550	100,100
120	0	0	0	0	0	0	0	0	110-120	0	1550	100,100
130	0	0	0	0	0	0	0	0	120-130	0	1550	100,100
140	0	0	0	0	0	0	0	0	130-140	0	1550	100,100
150	0	0	0	0	0	0	0	0	140-150	0	1550	100,100
160	0	0	0	0	0	0	0	0	150-160	0	1550	100,100
170	0	0	0	0	0	0	0	0	160-170	0	1550	100,100
180	0	0	0	0	0	0	0	0	170-180	0	1550	100,100
DEG	LUMINOUS INTENSITY:cd									UNIT:lm		

Isocandela Diagram:



Luminous Distribution Intensity Data:

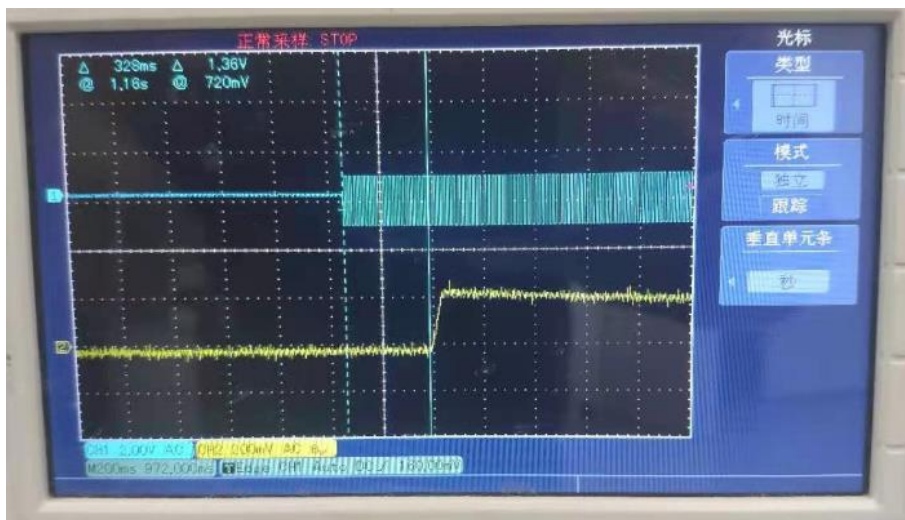
Table--1

UNIT: cd

C (DEG) Y (DEG)	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5			
0	705	705	705	705	705	705	705	705	705	705	705	705	705	705	705	705			
5	701	701	700	700	700	700	700	699	700	700	700	700	700	701	701	701			
10	688	688	688	688	687	687	686	686	687	686	687	687	688	688	689	689			
15	668	667	667	667	666	665	665	665	665	665	666	666	667	668	668	668			
20	640	639	639	638	637	637	636	635	637	637	638	638	639	640	640	640			
25	604	603	603	603	602	601	600	599	601	601	602	603	603	604	605	605			
30	561	561	560	560	559	558	557	557	558	558	559	560	561	562	562	562			
35	512	511	511	511	510	508	507	507	509	509	510	511	512	512	513	513			
40	455	455	454	454	453	451	450	450	452	452	453	454	455	456	457	457			
45	392	392	392	391	390	388	387	387	389	389	391	392	393	394	394	395			
50	327	327	327	326	325	323	322	321	324	324	325	326	327	328	329	329			
55	260	259	259	259	257	256	255	255	257	257	258	259	260	261	262	262			
60	191	191	191	190	189	189	188	188	190	190	191	191	192	193	193	194			
65	124	124	124	124	123	123	123	123	125	125	125	126	126	126	127	127			
70	66.8	66.7	66.9	67.0	67.2	67.3	67.5	67.7	69.3	69.3	69.1	68.8	68.5	68.4	68.2	68.1			
75	31.2	31.3	31.5	31.7	32.0	32.2	32.4	32.6	33.6	33.5	33.4	33.2	33.0	32.6	32.3	32.0			
80	13.9	13.9	14.1	14.2	14.3	14.5	14.5	14.6	15.1	15.0	15.0	14.9	14.7	14.5	14.3	14.2			
85	5.26	5.33	5.43	5.59	5.77	5.91	6.03	6.12	6.40	6.37	6.27	6.14	5.97	5.79	5.63	5.54			
90	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
155	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
160	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
165	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
170	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
175	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			

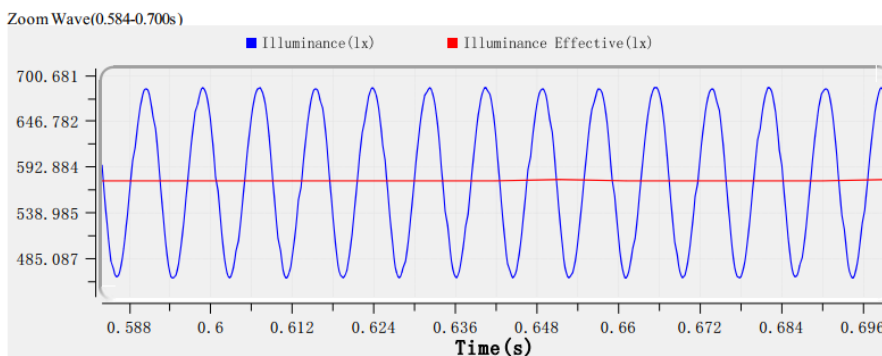
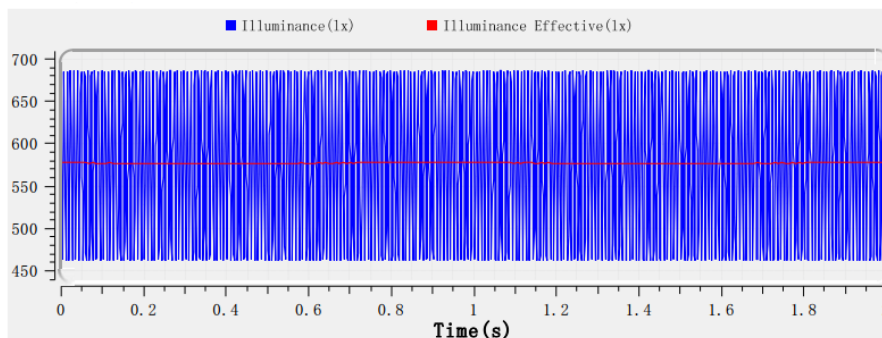
Source Start Time:

Test Result	Start Time (ms)
	328.0



Operating Frequency Test:

Test Result	Operating Frequency (Hz)
	120.0



Test Result

Max(lx):	686.6	Avg(lx):	576.7	Min(lx):	462.1
Flicker Index:	0.062	Percent Flicker:	0.000%	Frequency:	120.000 Hz

Power Factor Test:

Test Result	Power Factor
	0.9857

Standby Power Consumption:

Test Result	Power Consumption (W)
	0

Transient Protection Test:

Test Result	After Test
	Work Normal

Flicker:

Test Condition:

Parameter	Voltage (Vac)	Frequency (Hz)	Sampling Time (s)	Sampling Rate (kHz)
P _{st}	120	60	180	10
SVM	120	60	1	20

Test result:

Parameter	Result		
	Maximum Dimming Level	50% Dimming Level	Minimum Dimming Level
P _{st}	0.045	0.075	0.198
SVM	0.703	0.714	0.121

Dimming Test:

Test Result:

Test Result	100% Light Output (lm)	Min. Light Output (lm)	Dimming Level
	1549.9	118.0	7.61%

In-Situ Temperature Measurement Test Results:

Electrical Data:

Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor	Orientation	Test Time (hours)
120.0	60	0.1063	12.57	0.9857	Face Down	3.5

Test Result:

TC Location	Measured LED Drive Current (mA)	Temperature (°C)			Limits (°C)	TM-21 Result Reported L70 (hours)
		Ambient	Test Result	Corrected to 25°C		
TMP _{LED}	53.5	25.1	71.3	71.2	85	>60000

Test Result from TM-21:

Instructions

Yellow fields are completed by the user. Fields not used should be left blank. Cyan fields are calculated based on user entries.

First, enter a description of the LED light source tested. Then complete the fields labeled "LM-80 Testing Details". Test duration must be at least 6,000 hours. If only one case temperature data set is to be used (no interpolation), complete only "Tested case temperature 1". For only two case temperature data sets, complete 1 and 2.

Next, further to the right, in the corresponding box(es) for each tested case temperature, enter the test data along with the time (in hours) at which each measurement was taken. Data entered must be normalized then averaged measured data (per TM-21 sections 5.2.1 and 5.2.2). If case temperatures have different test durations, enter data up to the lowest of the test durations for all of the case temperatures.

Enter drive current, *in-situ* temperature data and the percentage of initial lumens to project to in the fields labeled "In-Situ Inputs".

Results can be tailored to estimate lumen maintenance at a specific time by entering a value (t) in the yellow field. A complete TM-21 report will appear on the next tab labeled "Report".

TM-21 Inputs

Description of LED Light Source Tested (manufacturer, model, catalog number)

Lextar Electronics Corp. PC35H13

LM-80 Testing Details

Total number of units tested per case temperature: 25

Number of failures: 0

Number of units measured: 25

Test duration (hours): 10000

Tested drive current (mA): 100

Tested case temperature 1 (T_c, °C): 85

Tested case temperature 2 (T_c, °C): 105

Tested case temperature 3 (T_c, °C):

In-Situ Inputs

Drive current for each LED package/array/module (mA): 53.5

In-situ case temperature (T_a, °C): 71.2

Percentage of initial lumens to project to (e.g. for L₇₀, enter 70): 70

Results

Time (t) at which to estimate lumen maintenance (hours): 50,000

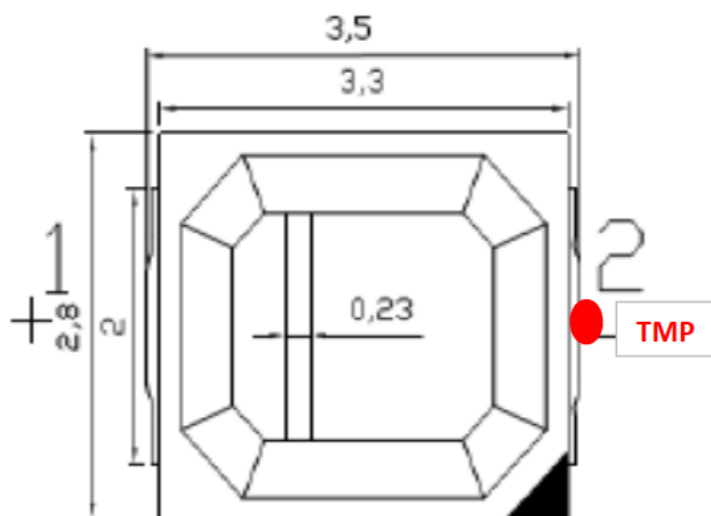
Lumen maintenance at time (t) (%): 78.94%

Reported L70 (hours): >60000

LM-80 Test Inputs

Test Data for 85°C Case Temperature		Test Data for 105°C Case Temperature		Tested Case Temperature 3	
Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
0	100.00%	0	100.00%		
1000	100.94%	1000	100.92%		
2000	100.44%	2000	100.02%		
3000	99.97%	3000	99.26%		
4000	99.35%	4000	98.47%		
5000	98.60%	5000	97.49%		
6000	97.98%	6000	96.73%		
7000	97.35%	7000	95.88%		
8000	96.92%	8000	95.31%		
9000	96.61%	9000	95.02%		
10000	96.16%	10000	94.45%		

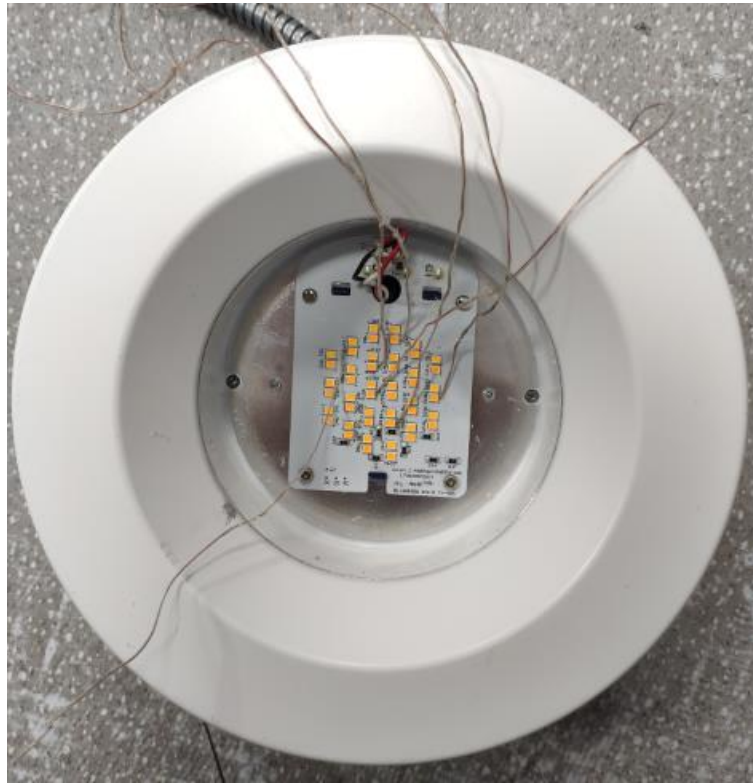
TMP Position in LM-80:



Temperature Measurement Point

Thermocouple Position on TMP:





Maximum Measured Driver Case Temperature Test Results:

Electrical Data:

Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor	Orientation	Test Time (hours)
120.0	60	0.1063	12.57	0.9857	Face Down	3.5

Test Result:

TC Location	Temperature (°C)			Limits (°C)
	Ambient	Test Result	Corrected to 25 °C	
TMP _{Driver}	25.1	87.7	87.6	105

Thermocouple Position on TMP



Annex:

Data Comparison for different Wattage&CCT Setting					
Wattage &CCT Setting	Voltage (V)	Frequency (Hz)	Wattage (W)	Total Luminous (lm)	Luminous Efficacy (lm/w)
7W 3000K	120.0	60	6.342	808.13	127.43
7W 3500K	120.0	60	6.296	834.23	132.50
7W 4000K	120.0	60	6.294	845.93	134.40
9W 3000K	120.0	60	8.596	1091.0	126.92
9W 3500K	120.0	60	8.457	1147.3	135.66
9W 4000K	120.0	60	8.676	1164.1	134.17
13W 3000K	120.0	60	12.57	1549.9	123.30
13W 3500K	120.0	60	12.26	1632.0	133.12
13W 4000K	120.0	60	12.47	1622.2	130.09

Equipment List:

Equipment ID	Equipment Name	Last Cal.	Due Cal.
NTC-F01-006	2.0 meter Integrating Sphere	2020-11-12	2021-11-11
NTC-F01-013	Standard Lamp	2020-11-12	2021-11-11
NTC-F01-031	Digital Power Meter	2020-08-22	2021-08-21
NTC-F01-019	Temperature & Humidity Meter	2020-11-13	2021-11-12
NTCD-S049	Digital Phosphor Oscilloscope	2020-11-12	2021-11-11
NTCD-S001	Temperature Data Logger	2020-11-12	2021-11-11
NTC-F01-047	Flicker Meter	2020-11-12	2021-11-11
NTC-F01-032	Surge Meter	2020-12-15	2021-12-14

*******End of Report*******